P1

Large scale three-dimensional cartilage tissue engineering using adult bone marrow stem cells from OA patients

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Purpose: We have previously shown the ability of adult BMSCs to engineer mature cartilage on 4 mm PGA scaffolds. However there is need to increase the construct size in order to successfully treat patients with large cartilage lesions. The aim of this study was to investigate scaling up our current tissue engineering protocol by increasing the scaffold size to 8mm diameter and comparing natural collagen (Chondrogide®) and synthetic (PGA) scaffolds.
Methods and Materials: BMSCs were expanded using growth medium with cytokines to maintain stem cell growth and chondrogenic potential. Cells were seeded onto Fibronectin coated (8mm) PGA and Chondrogide® scaffolds and cultured for 35 days in TGF-β3 supplemented differentiation medium. Samples were biochemically and immunohistochemically analysed for GAG, type I and type II collagen.
Results: 8mm PGA constructs (n=5) showed synthesis of GAG (50 % mean dry weight), type II (9.4 %) and type I collagen (2.1 %). Chondrogide® (n=5) also showed GAG (30 %), type II (17 %) and type I collagen (2.66 %). 4mm PGA scaffolds (n=20) showed synthesis of GAG (35 %), type II (17 %) and type I collagen (1.64 %). There were no significant differences in matrix composition between the various scaffolds. All constructs stained positive for GAG, type I and II collagen.
Conclusions: We have successfully engineered cartilage constructs using stem cells from OA patients. Our tissue engineering protocol can be scaled up to larger sizes and applied to natural and synthetic scaffolds to deliver high quality implants using stem cells from OA patients as a cell source.

P2

Injectable mesenchymal stem cell-hyaluronic acid(MSC-HA) therapy for cartilage defects- preliminary results

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Purpose: Current techniques in biological resurfacing of cartilage defects require an open arthrotomy or arthroscopy and involve the direct transplantation of isolated cells and or scaffolds, or whole tissue grafts with chondrogenic potential onto the cartilage defect. Our study investigates the effect of direct intra-articular injection of mesenchymal stem cells (MSCs) suspended in hyaluronic acid (HA) as an alternative to methods currently available.
Methods and Materials: Thirty patients with cartilage defects in the medial femoral condyle were selected for the study. Autologous mesenchymal stem cells from the iliac crest marrow were harvested under local anaesthesia and cultured in GMP laboratory. 2 weeks later, a microfracture was performed, and BMSCs suspended in 2ml of Synvisc® (Hylan G-F 20) were injected intra-articularly 10 days later. This was followed by 2 more injections of Synvisc® (HA) at weekly intervals. The controls were knees treated only with microfractures. Pre- and postoperative SF-36 and IKDC subjective knee scores were analyzed. Post-operative MRIs were performed in all knees at 6 months post-operation.
Results: There were no complications such as infections during the mean follow-up period of 9 months. There were significant improvements in the SF-36 domains for Physical Function, Bodily Pain, Physical and and IKDC score. MRIs performed after surgery documented cartilage regeneration with some sub-chondral reconstitution of defects.
Conclusions: The use of intra-articular injections of mesenchymal stem cells suspended in HA is a viable option for treating large cartilage defects. This injectable method has good prelimnary results but requires long term evaluation.

P3

Prospective evaluation of osteochondral defects in the knee treated with biodegradable scaffolds

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Purpose: This study reports on the usage of a biodegradable polymeric scaffold to treat symptomatic full thickness chondral and osteochondral defects of the knee.
Methods and Materials: In a prospective manner, following IRB approval, 47 sequential patients were treated over 2 years. The cylindrical orthobiologic scaffolds were surgically implanted to restore a smooth surface contour. Concurrent procedures included: 8 ligament reconstructions, 15 meniscal treatments, 3 patella realignments, and one hardware removal. All patients underwent preoperative and postoperative clinical and radiographic evaluation and were systematically followed at regular intervals. Postoperatively, all patients were maintained touch down weight bearing with crutches for 6 weeks, allowing immediate full range of motion.
Results: Mean follow up was 20 months (range 8 to 34 months). Mean age was 42 years. Mean number of grafts was 1.9 (range 1-7, total 82). Mean area grafted was 1.4 cm^2 (range 0.4-3.1 cm^2). SF-36 Physical mean score improved from 36 pre-treatment to 47 post-surgery. IKDC mean score improved from 32 to 64. The Lysholm mean score improved from 39 to 79. There was no radiographic evidence of bone lysis or evident complications. Two patients were deemed failures, and went on to arthroplasty for what were felt to be concurrent, unrelated pathologies. There were no other failures, and no complications related to the scaffolds were identified.
Conclusions: All patients, except two, showed significant improvements post-treatment as measured by each of the scoring instruments. This technology shows significant promise in the clinical management of relatively small chondral and osteochondral defects.

P4

All-inside suture techniques have advantages over inside-out sutures for Collagen Meniscus Implant (CMI) fixation

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Purpose: Traditional fixation of Collagen Meniscus Implants (CMI) to meniscus remnants has been inside-out sutures. We developed all-inside suturing of CMI using FasT-Fix (Smith&Nephew) to minimize inherent limitations. This study compared inside-out suture results with all-inside results.
Methods and Materials: Six patients underwent medial CMI implantation with inside-out sutures. Twenty-six patients had medial CMI implanted using an all-inside technique. We compared meniscus defect size, CMI length, number of sutures or fixation devices, operative time, intraoperative complications, and complications over twelve postoperative weeks. Data were analyzed using an independent t-test.
Results: Defect size and CMI length for inside-out patients averaged 45 mm and 50 mm, and for all-inside patients 46 mm ($p=0.92$) and 48 mm ($p=0.58$), respectively. Average total operative time of 135 minutes for inside-out patients decreased significantly to 73 minutes for all-inside patients ($p=0.0001$). On average, 8.5 sutures were used for inside-out technique, and 5.2 FasT-Fix devices were used for all-inside ($p=0.0001$). There was significant correlation between operative time and sutures ($r=0.55$; $p=0.001$). There was one effusion and one intraarticular infection that required reoperation in inside-out group. In FasT-Fix group, one CMI was damaged, requiring a second CMI, and there was one effusion at 10 weeks that required arthrocentesis twice. No late or persistent complications were observed.
Conclusions: All-inside FasT-Fix to secure CMI to the host meniscus rim significantly reduced total operative time compared to inside-out sutures for equal lesions and similar CMI length. Patient morbidity was reduced the first twelve postoperative weeks. No serious clinical complications were encountered using all-inside FasT-Fix.